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ABSTRACT

This paper presents Rowland's Ways of Knowing and Decision-making Model for curriculum development and how it can be applied to environmental education curricula. The model uses a problem solving approach based on steps of: (1) coming to know the problem through the ways of knowing of the disciplines and personal knowledge; (2) proposing solutions to the problems using the applied disciplines; and (3) using an ethical/moral framework for evaluating the proposed solutions and choosing one for personal action. An example is provided from a seventh grade class that investigated the issues surrounding the Glen Canyon Dam controversy through the study of native and exotic plants, endangered fish and their habitat requirements, fishing techniques used in the river, the biology of the area before the dam was built, and general ecological principles. (MDH)

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Developing Environmental Decision-making in Middle School Classes

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Developing Environmental Decision-making in Middle School Classes

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A key function of environmental education is to help students learn how to make good decisions about environmental issues. Rowland's (1991) Ways of Knowing and Decision-making Model for curriculum development is based on that assumption and uses a problem solving approach based on steps of 1) coming to know the problem through the ways of knowing of the disciplines (sciences, social sciences, language, mathematics, the arts, history, philosophy, theology) and personal knowledge; 2) proposing solutions to the problems using the applied disciplines (engineering, management, media, education, health professions, etc.); and 3) using an ethical/moral framework for evaluating the proposed solutions and choosing one for personal action. A key component of the model is that students come to understand how the disciplines create knowledge and how one judges the adequacy of that knowledge. At the middle school level, the emphasis is on how we come to know about the problem and how we can use that knowledge in our decision-making. Since students at the middle level (ages 11-15) are just developing a set of ethics to guide their decision-making, it is important that they be given the opportunity to express their decisions in the form of public action that requires them to experience the responsibility associated with taking a stand. The model attempts to reconcile the value of disciplinary knowledge with the real world of problems and issues. In addition, the model recognizes the need to make decisions even when the available information is incomplete.

The model implies a series of lessons that are developed to allow students to find out what they can about an issue/problem using knowledge from the various disciplines or subject areas. We have found it useful to develop this series of lessons in the format of a module. The process of defining what a module is has been difficult. We all understand that instruction is divided into chunks but we sometimes disagree on what constitutes a chunk or what belongs in a chunk. What has evolved from our experiences is a definition that is based on how big of a chunk of instruction makes sense (in an integrated way) to the learner. Consequently, our view of how big of an instructional chunk is a module depends on several factors such as the age of the learner, the topic, the goals of the teacher, etc. We define a module as a chunk of instruction that allows students to come to some conceptual understanding about an issue

and to use that understanding to solve a problem or take a position on the issue. Some important considerations in module development are: the relevance of the issue or problem to the students; the ability to use the module to integrate a variety of subject areas or ways of knowing; and the length of the module.

For example, if I choose as a topic of a module, water conservation, I need to determine what I want my students to understand about water conservation and what knowledge, skills, and beliefs are required for them to understand it. I also need to think about how to ensure that the knowledge will become integrated and useful to them; so the module not only organizes the content of the instruction but also organizes the delivery of the content to maximize student motivation, involvement, etc. The module should hold together such that the learner uses understandings from all parts of the module to deal with a real issue.

Another consideration is the length of the module. If my overall goal is broad and is to be met by several specific objectives, then the module may take many weeks. On the other hand, if the module is fairly narrow in conceptual scope then the module may only be a few lessons long (this is more common with modules for primary students). Whatever its length, the module is an organized unit of instruction that develops decision-making through understanding.

A set of modules developed by teachers from Page (AZ) Middle School (Mike Munoz, Carol Adkins, and Pam Everhart) during Project ASEED (Arizona Science and Environmental Education Development) illustrates the Ways of Knowing and Decision-making model. The issue addressed by the modules was, "Do Glen Canyon Dam releases and other human activities have a negative impact on the Grand Canyon ecosystem?" The sixth grade module focused on principles of erosion and the effect of human impact on the Colorado River's beaches. In seventh grade, students learned about the principles of riparian ecology and endangered species of the Colorado River. Hydroelectric power generation and the environmental impact of dam operations were studied by the eighth grade classes.

The modules were implemented in seventh grade life science classes and in eighth grade physical/earth science classes (the sixth grade sections on erosion were implemented in the eighth grade classes due to teacher reassignment).

In the seventh grade classes, students became familiar with the issues surrounding the Glen Canyon Dam controversy through the study of native and exotic plants, endangered fish and their habitat requirements, fishing techniques used in the river, the biology of the area before the dam

was built, as well as general ecological principles. Throughout this section of the module (the ways of knowing section), there was an emphasis on understanding the human impact on the Grand Canyon ecosystem. A key aspect of learning about the problem was field trips and data collection at two Colorado River sites. The first field trip was taken to Lee's Ferry where students wrote site descriptions and gathered data about plants, animals, water temperature, coliform levels, and human impact on beaches. A second field trip was taken to Havasu Canyon, a tributary of the Colorado River. The same type of data was gathered at this site.

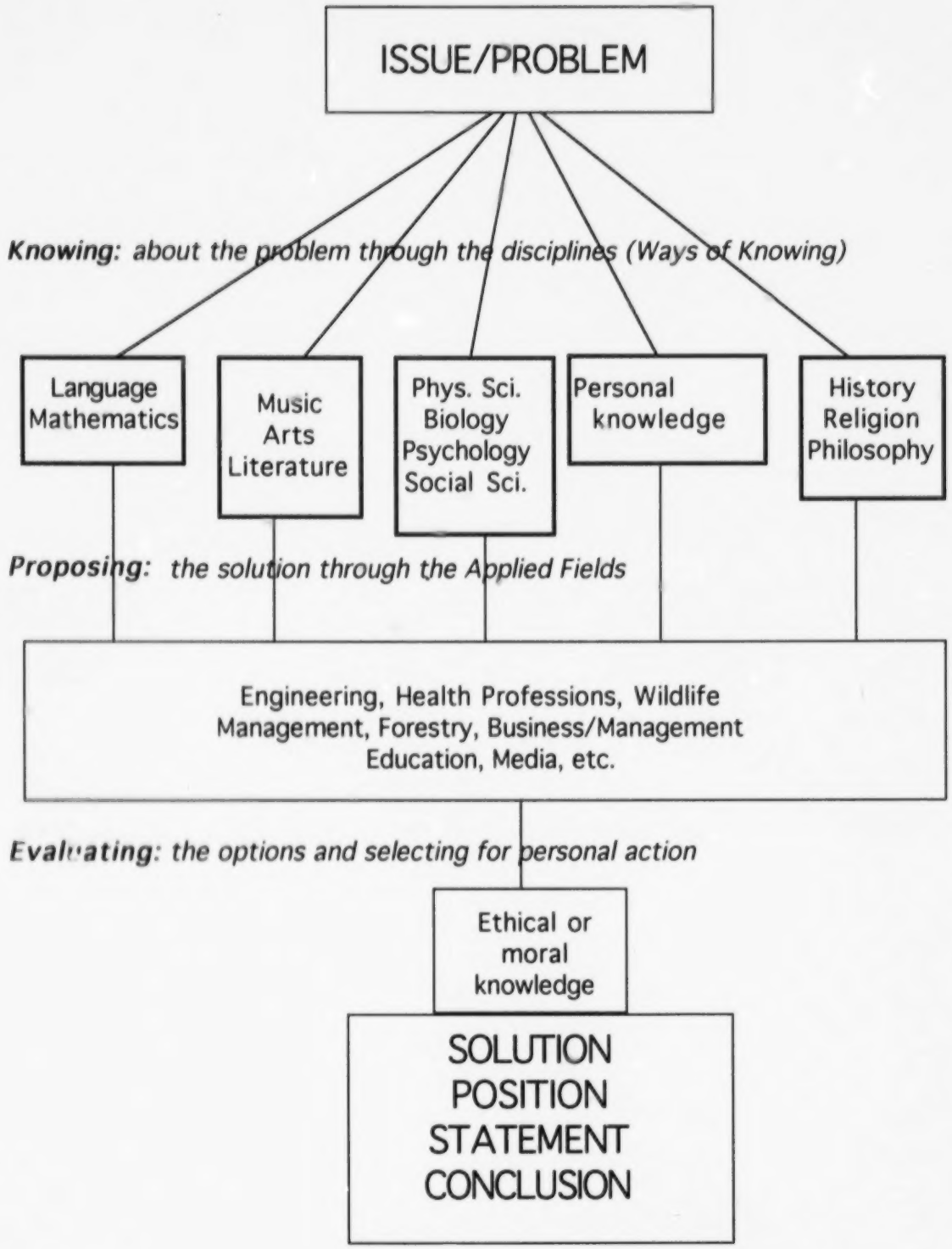
The data were organized into charts and graphs to allow comparison of different sites studied. That information was then used to develop proposals for dealing with specific problems such as: the impact of visitors on Havasu Canyon and the Colorado River at Lee's Ferry and preventing the extinction of endangered fishes. These proposals were sent to Arizona Game and Fish and the National Park Service.

The eighth grade students studied water chemistry, hydroelectric power generation, and the history, structure and use of Glen Canyon Dam. As a part of their study they toured the dam and the power generation facilities in it. They also took part in the field trips to Lee's Ferry and Havasu Canyon where they conducted water chemistry tests. Then they summarized their data in charts and graphs.

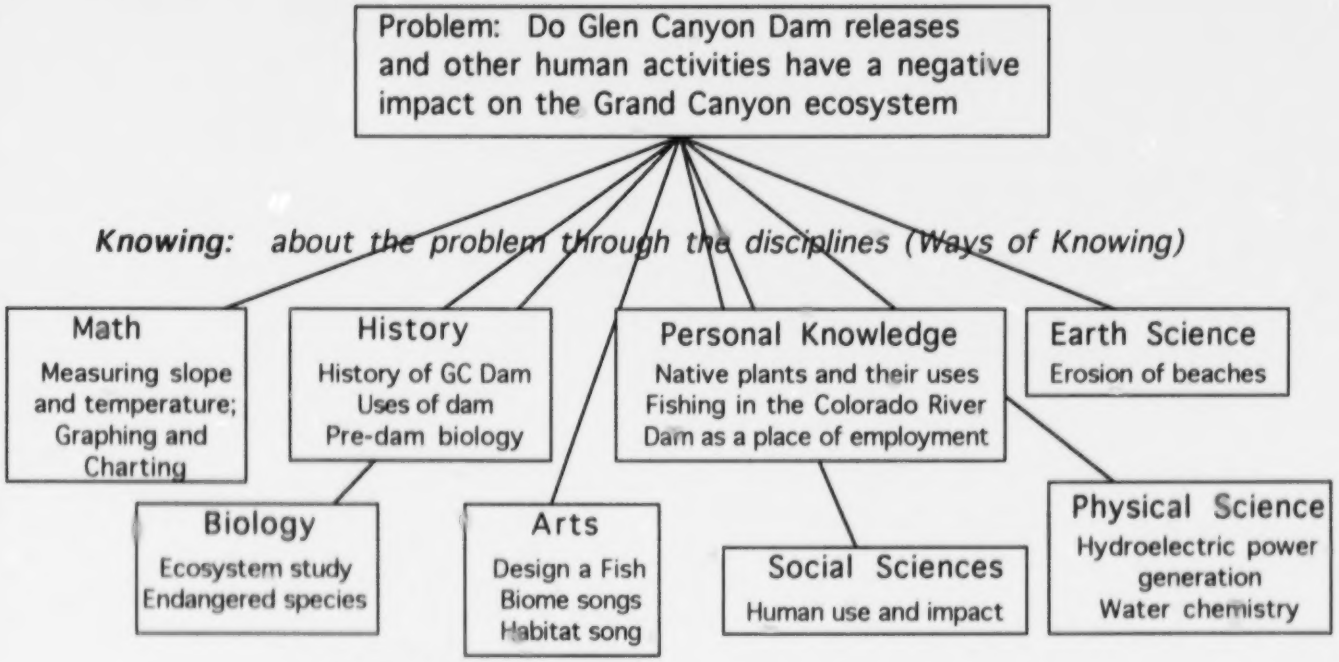
The eighth grade students conducted a mock congressional hearing on the impact of the Glen Canyon Dam releases. During the hearing, the seventh and eighth grade students who had collected data, served as expert witnesses to provide information to the "legislators" and to present various proposals for dealing with the impact of the dam. At the end of the hearing each student adopted a position and wrote a paper on what should be done about the impact of the dam. They then wrote to policy-makers making suggestions and providing supporting data.

The modules described above include many elements of the Ways of Knowing and Decision-making model. Students used the disciplines to know about the problem, proposed solutions to the problem and evaluated the options to select a plan of personal action.

Rowland, Paul McD. (1991). When does science education equal environmental education? In: Baldwin, J.H. (Ed.) Confronting Environmental Challenges in a Changing World. Troy, OH: NAAEE.


ISSUE/PROBLEM
Knowing: about the problem through the disciplines (Ways of Knowing)
Language Mathematics
Music Arts Literature
Phys. Sci. Biology Psychology Social Sci.
Personal knowledge
History Religion Philosophy
Proposing: the solution through the Applied Fields
Engineering, Health Professions, Wildlife Management, Forestry, Business/Management Education, Media, etc.
Evaluating: the options and selecting for personal action
Ethical or moral knowledge
SOLUTION POSITION STATEMENT CONCLUSION

Ways of Knowing and Decision-making Model



Proposing: *the solution through the Applied Fields*

Fisheries:
Proposals developed for saving the endangered fish were sent to AZ Game and Fish

Management:
Proposals for management of releases from the dam.

Laws and Regulations
Some proposals required the development of laws and regulations

Management:
Proposals for the mangement of human impacts were sent to US National Park Service

Engineering:
Some proposals for controlling the effect of releases involved the building of dam structures

Evaluating: *the options and selecting for personal action*

Making a Decison
The information and proposals were presented at a mock congressional hearing. At the end of the hearing each student wrote a position paper and defended their position on the plan of action they chose.

Acting on the Decision
Students wrote to their elected officials or to agency heads concerning their views on the issue

An Application of the Ways of Knowing and Decison-making Model